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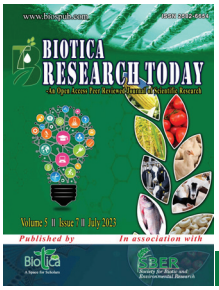

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Micro-Pollutants on the Environment: Causes, Impacts and Solutions

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Abstract

Micropollutants are substances that originate from human activities and are found in low concentrations (micrograms) in the hydrosphere, lithosphere and atmosphere that impact a negative influence on environmental health. Increased use of synthetic chemicals including agriculture (pesticides and fertilizers), consumer goods (flame retardants, microplastics, perfluorinated compounds), pharmaceuticals (drugs, synthetic hormones), personal hygiene products and industries has resulted in the presence of micropollutants within the human habitat. The article describes micropollutants influence on environment including water contamination, soil degradation and air pollution, as well as adverse impacts on terrestrial and aquatic living beings. Lastly, the article explores various solutions to alleviate the effects of micropollutants, including enhancing waste management systems, implementing more stringent regulations, fostering the development of alternatives and attention to this pressing affair.

Keywords: Contaminants, Environmental impact, Micropollutant, Solution

Introduction

Micropollutants, which are small-scale (microgram or ppm level) chemical and biological materials found in the human habitat, create a substantial hazard to the ecosystem. These substances as emerging pollutants can have profound and enduring impacts on living organisms. These emerging contaminants can be found in the hydrosphere, lithosphere and atmosphere.

Pharmaceuticals

Pharmaceuticals, which are commonly known as drugs, play a crucial role in allopathic medicine to cure comprehensive illnesses, including minor ailments like common colds, headaches to chronic illnesses (cancer diabetes). However, the presence of pharmaceuticals in aquatic systems has been concerned about the impact on environmental health.

Pharmaceuticals can enter water systems through various pathways. When drugs are excreted from the body through urine or disposed of as wastewater, they have the potential to infiltrate water sources (Rogowska *et al.*, 2020). Conventional wastewater treatment plants are designed to treat pollutants and are not able to remove pharmaceuticals.

Generally, consumers discard excess or expired medicines through general waste or in toilet flushes can also result in a leach to surface and groundwater systems. Furthermore, pharmaceuticals administered to animals can enter water bodies through their compost. Research is needed to find the suitability of different advanced wastewater treatment techniques like biological treatment, advanced oxidation process and/or a combination of both the above treatment.

The presence of pharmaceuticals as micropollutants in wastewater systems warrants significant attention due to the potential environmental and health implications. Although the concentrations of these drugs in water are typically in micrograms, they have a potential impact on aquatic living beings like fish, invertebrates and amphibians. Moreover, evidence suggests that exposure to pharmaceuticals affects mostly municipal workers. Now is the optimum time for addressing the concerns and taking appropriate measures by mitigating any risks associated with pharmaceuticals.

Now it is essential to address the above issue by implementing systematic planning. Firstly, enhancing wastewater treatment processes can improve the removal of these drugs from water sources. Secondly, the promotion of safe

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disposal practices for drugs through buy-back policies and disposal guidelines is crucial. Lastly, the prescription and utilization of drugs at recommended level can effectively reduce the influx of pharmaceuticals into wastewater systems. While pharmaceuticals play a vital role in modern medicine, their presence in water systems raises concerns. Taking proactive measures to minimize their environmental and health impact, such as refining treatment processes, ensuring proper disposal practices and advocating for responsible drug use is essential. By implementing these measures, we can maintain the benefits of pharmaceuticals while mitigating of negative effects on the ecosystem and human health.

Personal Care Products (PCPs)

Personal care products, including cosmetics, lotions and perfumes, have become an integral part of our daily routine. Regrettably, numerous chemicals present in these products can pose a detrimental influence on both human health and the environment when washed away and disposed of entering water systems as micropollutants.

PCPs as Micro-Pollutants

Personal care products include a range of substances like phthalates, parabens and triclosan. They are linked to hormonal imbalance and reproductive disorder concerns.

When we use PCPs, they enter our bodies and are ejected through excreta. As a result, they find their way into the sewage system and ultimately enter oceanic and other aquatic systems including fresh waterways and they persist for extended periods, harming aquatic life and magnifying in food chain.

It was demonstrated that PCPs serve as one of the significant sources of micropollutants in aquatic environments. As per the US Geological Survey, a minimum of one PCP were detected in half of the water samples from US waterways.

To alleviate the problem of PCPs as micropollutants, both individuals and companies can take steps. On an individual level, reducing the use of personal care products, selecting environmentally friendly alternatives and ensuring proper disposal can make a difference. Similarly, companies can play their part by reformulating their products to prevent hazardous formulations and implementing improved practices like labeling to inform potential consumers about the environmental hazards associated with the products of purchase.

Pesticides and Herbicides

Pesticides and herbicides play a vital role in safeguarding crops and plants from insects, pathogens and weeds in agricultural and horticultural systems. Nevertheless, it is important to recognize that these chemicals are classified as micropollutants because of their adverse effects on the ecosystem and its health. Designed to be toxic to specific organisms, pesticides and herbicides can inadvertently harm organisms including birds, beneficial insects and mammals (non-target organisms) that come into contact with them (Lata *et al.*, 2021).

The persistent pesticides can accumulate and magnify in the food web/ chain (biomagnification) in the course of time. To ameliorate the ill effects of pesticide chemicals in agriculture, adoption of responsible measures and exploring alternative approaches to pest and weed control. This can be achieved by utilizing these chemicals judiciously and considering alternative methods such as crop rotation, integrated pest management and biological control. By implementing these strategies, we can reduce the reliance on pesticides and herbicides while maintaining effective pest and weed management.

Adverse Effects of Pesticides and Herbicides

The impact of pesticides on keystone species honey bees, butterflies and frogs can affect the ecosystem by complete deletion. Humans may experience various health issues, like respiratory illness, skin problems finally to cancer. Moreover, soil contamination and water pollution lead to unlimited environmental consequences.

Now it is essential to avoid banned pesticides and adopt integrated pest management to reduce the ill effects of pesticides. Alternative methods such as crop rotation, and biological control should be adopted. We can reduce the reliance on pesticides and herbicides while maintaining effective pest and weed management by implementing these strategies.

Flame Retardants

Flame retardants are additives incorporated into furniture and electronics to arrest the fire spread. Normally flame retardants enter the environment along with particulate matter and the atmospheric air (Jamie *et al.*, 2023). However, these chemicals can render deleterious effects on human and environmental health.

Flame retardants can enter the environment through multiple pathways, with one of the primary routes through particulate matter. When utilizing or managing products that incorporate flame retardants, these substances have the potential to be emitted into the air and accumulate as dust within indoor environments. Humans and animals can then ingest or inhale this dust, potentially leading to health issues. Additionally, the disposal of products containing flame retardants can result in the contamination of the environment. Contamination of flame-retardant nearby e-waste processing centers into soil and water systems exacerbates environmental pollution.

The flame retardant as micropollutants on human health is a significant concern. Exposure of flame retardants leads to health issues like cancer, developmental delays and thyroid disorders. The detrimental health consequences are thought to stem from the disruption of hormonal systems and interference with normal bodily functions induced by flame retardants. Wildlife and ecosystems are likewise vulnerable to the detrimental impacts of these substances. Research has indicated that flame retardants can accumulate in animal tissues, resulting in reproductive problems and alterations in behavior. Additionally, flame retardants have a tendency to persist in the environment for extended durations, presenting challenges for their eradication once they are released.

As the awareness of the risks linked to flame retardants as micropollutants grows, efforts are made for reducing their utilization in products manufactured and seek alternatives. Some companies are introduced natural flame resistors, while others are developing technologies for the elimination of the need for flame retardants. Regulations are also in practice to restrict the use of particular flame retardants. It is crucial to take steps to minimize the use of flame retardants and explore safer options as awareness of their risks increases. By adopting so, we can safeguard human health and the environment from the adverse effect of flame retarding micropollutants (Jamie *et al.*, 2023).

Microplastics

Microplastics consist of minute particles usually sized less than 5 micrometers that originate from fragmented larger plastic objects such as packaging, water bottles and synthetics and can be discovered in ocean salt water (Figure 1), freshwater, soil and the atmosphere. These tiny plastic particles are classified as micropollutants and have garnered attention recently because of their persistence in the environment and the ecosystem (Issac and Kandasubramanian, 2021).

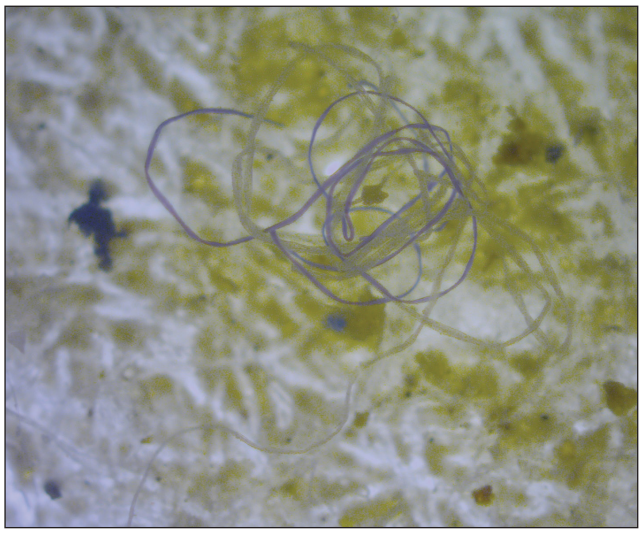

Figure 1: Microplastic fiber identified in the ocean

Increased generation of plastic waste was related to the manufacture and use of plastic products. Plastic waste enters the environment through landfill leakage, littering and ocean disposal. Plastic can be degraded by microorganisms in due course of time into smaller particles and also melt due to sunlight and weathering processes.

A diverse array of organisms, such as fish, birds and other marine animals, are susceptible to ingesting microplastics, which can cause physical harm and disrupt their behavior and reproductive abilities. Furthermore, the presence of microplastics in drinking water and food items concerned the health risks of humans. The ingestion of microplastics by organisms can result in physical damage, change in behavior and reduction in reproductive potential.

A complete understanding of microplastics on human health is not fully developed; however, microplastics can attach and emit harmful substances, such as endocrine disruptors and cancer-producing substances called carcinogens Moreover, microplastics in the environment lead to financial consequences by harming marine life and business reliant on tourism and fishing.

A decrease in the production of plastic waste is followed by preventing the release of microplastics into the ecosystem by the reduction of single-use plastics, the adoption of an integrated solid waste management strategy, and the advancing of suitable recycling technologies and waste-to-energy (WtE) conversion systems.

Perfluorinated Compounds (PFC)

Perfluorinated compounds are notable micropollutants that possess the potential to cause deleterious effects on both eco system and the environment (Sudarshan *et al.*, 2022). The extensive utilization of perfluorinated compounds (PFCs) in consumer and industrial products poses an ongoing challenge for environmental regulators and municipality personnel because of their persistence. Measures are adopted to reduce the utilization of PFCs, but addressing this issue comprehensively will require time and effort. Before this, it is crucial to remain cognizant of the risks of PFCs and follow necessary precautions towards minimizing our contact with PFCs.

Conclusion

In conclusion, micropollutants represent a significant challenge for both the environment and public health. Despite their low concentrations, they can exert long-term effects on various organisms. Mitigating the presence of micropollutants necessitates a collaborative approach involving governments, industries and individuals. This entails reducing the usage of hazardous chemicals and enhancing advanced treatment methods adoption followed by raising education about the affairs among the general public. By collectively addressing micropollutants, we can safeguard the environment and promote the well-being of future generations.

References

Issac, M.N., Kandasubramanian, B., 2021. Effect of microplastics in water and aquatic systems. *Environmental Science and Pollution Research* 28(16), 19544-19562. DOI: https://doi.org/10.1007/s11356-021-13184-2.

Jamie, P., Paul, W., Michelle, B., Linda, S.B., Aleksandra, C., Delyth, F.D., Ruth, G., Stuart, H., Frank, K., Andreas, K., Olwenn, M., Anna, S., Tom, W., 2023. A new consensus on reconciling fire safety with environmental & health impacts of chemical flame retardants. *Environment International* 173(1), 107782. DOI: https://doi.org/10.1016/j.envint.2023.107782.

Lata, R., Komal, T., Neha, K., Neelam, S., Sukhbir, S., Ajmer, S.G., Arun, L.S., Jyotsna, K., 2021. An extensive review on the consequences of chemical pesticides on human health and environment. *Journal of Cleaner Production* 283, 124657. DOI: https://doi.org/10.1016/j.jclepro.2020.124657.

Rogowska, J., Cieszynska,-Semenowicz, M., Ratajczyk, W., Wolska, L., 2020. Micropollutants in treated wastewater. *Ambio* 49(2), 487-503. DOI: https://doi.org/10.1007/s13280-019-01219-5.

Sudarshan, K., Jason, D., Sushil, R.K., Mallikarjuna, N.N., Ryan, W.C., Balram, A., Garrett, C.S., Richard, W., 2022. Per- and polyfluoroalkyl substances in water and wastewater: A critical review of their global occurrence and distribution. *Science of the Total Environment* 809, 151003. DOI: https://doi.org/10.1016/j.scitotenv.2021.151003.